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Porcellanato Tile Finishings over Wood Structures in the Giorgio Armani Retail S.R.L. – Avenida da Liberdade 220 - Lisboa

Architectural Project: Giorgio Armani SpA and Contacto Atlântico Arquitectura Lda (Arqt^{o} André Caiado)

Abstract

The refurbishments in old buildings in Lisbon means, usually, to know how to deal with wood structure floor boarding's buildings. The architects have almost always the problem of the finishing of these kind of floors with a different material from wood, because of the consequences of the stresses, the contractions and expansions of the wood in which floors are made and the curvature or flexion due to the flexibility of the material wood and also, due to the surcharges – persons as dynamic charges and the static ones, the weight of the furniture, shelves, goods, etc..

It is easier and cheaper to finish such pavements with a continuous coating, like wool or synthetic mats, epoxy resins or wood parquet or similar. However, the client has imposed its image with *gres porcellanato* over the floors like all the Armani shops over the world and a structural reinforcement solution has been required and a specific method for the floor covering to avoid cracks.

Morphology of the old buildings

The refurbishments in old buildings in Lisbon, before the fourties of the last century means, usually, know how to deal with wood flooring structures and stone and or brick masonry mixed up with wood structures, like a solid cage over the soil. Furthermore, most of these buildings have pile foundations of solid green pinewood ten or twelve diameter stakes, carved into the talwegs almost everywhere in the Lisbon historic and old valleys. Over them, a solid base with stone or brick masonry was built which receive the walls and all the structure. The levels of the low tide and the high tide of the sea and the Tagus River can be observed in Restauradores Plaza, in the deep foundations of its buildings. Solid direct stone foundations into the soil of the old buildings has no place in the lower part of the city and after the 1755 violent earthquake, attention has been paid from the authorities to the structures of all the new buildings and the skill of carpentry with masonry was developed since there and used everywhere in Lisbon and all the country until the Second World War Years.

Actually Lisbon has many and many ancient buildings prior to the 1st World War. The most important and largest avenues are opened to the public in the beginning of the XX th century, but there are also older ones. The most important locals for international commercial shops and fashion merchandizes, are settled in the most important and wider avenue, named *Avenida da Liberdade*. Is the case of Emporio Armani shop, a land mark of Italy, located in this avenue the *must* of the avenues of Lisbon, 1100 meters long and 90 meters wide. It links the downtown to the upper part of the City and is the place where the most important national and international trade companies have their head offices, as well the most important luxury hotels. It has been constructed according the Parisian *boulevards* since 1764, named in that time *Passeio Público* - Public Promenade - initially for the high bourgeoisie. Until 1886, acquired small falling cascades and many evocative statues and forced the city to be expanded from the Tagus border, the original old city, to the north direction. It becomes since the beginning of the XXth century a reference for wealthy people residences, who had constructed here their palaces, occupying them from down to the top.

Later on, almost all the palaces and residences ground floors at the level of the street became shops. It is considered nowadays, one of the most expensive streets in Europe, the 10th in the ranking between the luxury streets over the world[1] and many

[1] RTP (Portuguese TV Broadcast) Program, 25th april. 2013.

of the original and centenary buildings has been demolished and replaced for new ones not always with appropriate or wonderful architectural solutions. The historic heritage is dying in Lisbon and has been replaced since the fifties of the last century by the global architecture of the new glazing buildings. *Avenida da Liberdade* has the ability or the chance to attract clients, wealthy clients coming from everywhere, like Angola with a share of clients of 44%), Brasil with a share of 24% and Russia and China with a share of 6%, shares outside the European Union. Angola is the best client, the better consumer, and the tourist organizations as the Globe Shoppers or other similar ones plan the trips according the goods they wish to buy, in the tax free shopping system which receives a great international adherence. The original countries where they come from has not this representative trademarks, these *musts* that the principal shops of this place have and, it is important, they speak Portuguese, except the Russians or the Chinese. This place is attracting more and more tourists, coming from everywhere, as well the Portuguese wealthy people is coming from all the corners of Portugal. It is also the stage of all the important political displays where people claim for justice and their rights and, also, the stage for popular musical exhibitions. Everybody knows very well this avenue and passes before their eyes the new trends of the fashion. Every trade mark wishes to have their shops, representatives offices or luxury hotels here, the first reference of the city, and, of course, the most expensive. Of course, also, the disadvantage people have here their beds, sleeping over the thresholds of the banks, or near the air conditioning outlets.

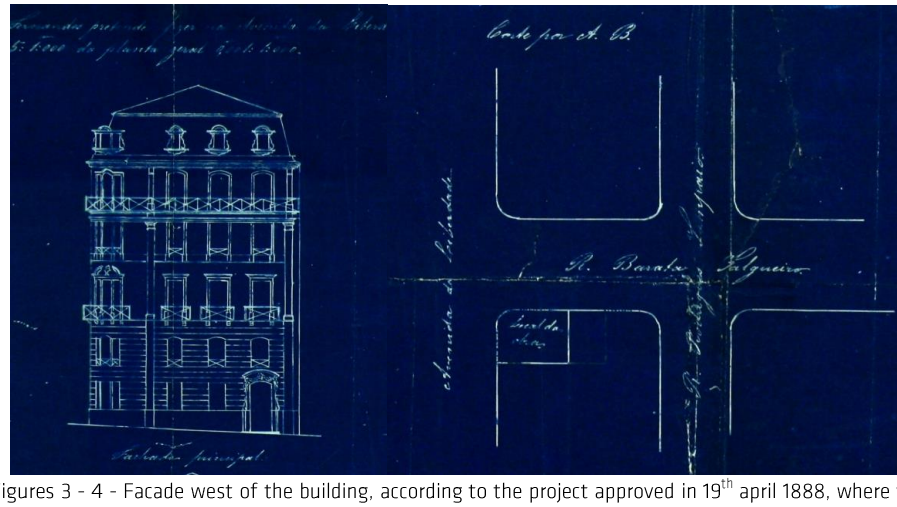
One of this original remaining buildings, the number 220 in the east side of the avenue, located in the corner with Barata Salgueiro Street, lodges, since some years, the well known *boutique* of Emporio Armani, one of the most important Italian *couturier*, for men and women, which desired refurbish and update its look, the windows dressings, the interior décors and the facades, already old fashioned for the selected and excellent clients. In the refurbishment project it had to be considered the architectural conditionings, the style of the whole building, its inside and outside pathologies and the decoration look of the Armani trade mark over the world, as well its structure and the morphologycall characteristicis of other previous refurbishments, amongst them the introduction of several structural concret reinforcements instead of steel solutions and the strong decay of some pieces of the floor wood structure.

Figure 1-2 - The building of Emporio Armani *Boutique* in the corner of Avenida da Liberdade and Rua Barata Salgueiro, in Lisbon. The front door entrance, with LCD displays in each side, to keep the atention

The building belongs to the late romantic creations of the last decades of the XIXth century contrasting, however, in its simplicity with the exuberant and decorated facades of many others, a label of this era, as, for example, the next closed building in the south gable, Valmor Prize in 1916 and drawn by

the well known architect Norte Junior. Viscount of Salreu, a rich business man, ordered the architect this beautiful land mark of the avenue already protected by municipal laws in order to preserve all the inside and outside morphologies.

The project of the building where Armani is established is dated from 1888 as shown in the original blue print in the figures 3 and 4 - the west facade and the site plan. The ground floor was originally built for lodging, but has been refurbished some years later for commercial use, more lucrative as many others in Lisbon under the same conditions, and in this avenue, almost all have done the same reconversion.



Figures 3 - 4 - Facade west of the building, according to the project approved in 19th april 1888, where we can see the lodging use of the actual *boutique* and the site plan, in the same era. There were no entrance in the corner of the streets, like nowadays

However, actually are yet still living, as tenants, in this avenue a lot of people, principally retired old ones, that have along their lives, watch the changes, the commercial promotion of the site and the raise of the apartments prices.

The space and the program of the new *Boutique* replacing the old-fashioned shop for the time being comprises two levels, one in the ground level with direct access from the avenue sidewalk and the other in the basement, The ground level has a surface of

192,63m2 and the basement 190,50m2. The head office of Emporio Armani in Italy gave the recommendations pointing out to several finishments for the floors and for the walls, as well for the shelves, furniture, lighting and all the decoration and the equipment, in order to give the same identity and image to the stores all over the world.

The main difficulty to accomplish the program and the finishments, was the structure of the building: wood structure floors, with wood flooring, stone masonry in the outside walls, and wood and plaster partitions inside but no concrete floors structures at all. The client demanded for unglazed and polished Italian grey *gres porcellanato* square tiles with 100x100 cm covering both the floors. In the basement there were no problems at all with this tiles, because there were no resistant structure, as the pavement was finished over a layer of stone and mortar over the natural compact soil. But in the ground floor the structure was as referred, made in wood, a flexible structure, and the glazing tiles have a unusual dimension and weight, 36kg eacht piece.

Morphological Characterization

The constructions with wood structure, current in every building in Portugal until the World War 2[d], are characterized by its look and the contractions and expansions of the wood in which floors are made and the curvature or flexion due to the flexibility of the material wood and also, to the surcharges – persons as dynamic charges, and goods, furniture, etc. as static ones. The thermal differential all day round over the external walls is high (day and night), as it is also the moisture, even in summer time as well in winter time and although the air conditioning or heating almost inexistent in all buildings, increases the probable thermal consequences of damage or cracking. The exterior and interior walls works as they whishes, because they have no thermal insulation and are facing the south and the west. In this case, there are two original iron cast columns under the ground floor structure. As the weight of merchandises, the people and the furniture foreseen shall be heavy, the structure of the ground floor has been analyzed and reinforced with a steel frame. The wood decayed beams and trimmer joists has been replaced, and reinforced also the referred iron casted columns, as shown in figure 5, enveloping the iron cast column with concrete, which we consider as a bad solution.

In the facades, facing both the streets, the works were simple, including however a foreseen enlargement of the shop windows dimensions, lowering the window sill,

replacing the metallic frames by stronger modern ones with more security, including the glazing type. By the other side, the new image or universal Armani adhesive Logo of the owner has been fitted over the glasses. The enlargement of the shop windows forces to study the local openings stability, in steel and concrete, for not put in risk the external walls. The original west facade was composed only by windows, but as it has been refurbished twice at least since the construction, there were no great changes in it. The interior partitions were demolished according the new arrangement of the *Boutique*, some of them yet from wood and plaster, to be replaced for new ones of fire resistant plasterboard fire performance over metal studs with intumescent fire sealers along the edges.

The ground floor and the basement are linked through a existing concrete staircase material unfortunately used in other previous refurbishments, instead of steel or wood but it is the usual structural way for Portuguese architects and contractors. A lift must be also placed between the two storey's for disable clients, as well an adequate platform in the entrance stairs attached in the handrail from the sidewalk.

Structural morphology

Due to the foreseen surcharges over the ground floor and considering the weakness of the structural wood frame for them, a steel reinforcement has been projected as referred to bear them considering the follow items:

- In the last refurbishment some years ago, has been done a slab of light concrete and expanded natural clay over the wood flooring, suitable for the floor finishments of small light ceramic tiles and thin wood mosaic avoiding to place them directly over the floor boarding, and consequently, its fissuration.
- The new *rectified gres porcellanato* tiles with100x100 cm size and a weight of circa 35 kg each (comply with ISO 13006 and European Standard EN 14411) with low linear thermal expansion.
- That means that the permanent static surcharge over the floor structure was about 36 kg/m2 plus the weight of the concrete slab the floor boarding and the furniture.
- The bending strength of the floor was then a motive of concern, as well the direct consequences over each tile and the combination of the two types of

materials was analyzed in order of each one could work without interference of the other and avoid damages from it.

- All the structural elements and the wood boarding lower part were overcoated with a fire resistant rock wool foam.

The structural reinforcement has reduced the possible and probable deformation of the floor to a minimum but the three materials joined together work in 3 different ways when in service, due to their own contractions and the expansions as well the thermal characteristics were also much different. At least, the ceramic tiles must be independent from the under layers, to allow its movement for each side and avoid the possible fissuration. The joints in this case and by themselves could absorb the work movements and stresses.

Figure 5 - Steel reinforcement of the wood structure in the basement ceiling. The enveloping of the iron cast column with concrete seems to us a bad solution, because it hides forever the history of the old structure and could be done, preferably in steel, easy to observe and easy to dismantle

Formerly, in fifties and sixties of the XXth century, a layer with the minimum of 30 mm of sand was used in this cases under another layer with the same thickness of mortar, reinforced or not with a wire mesh which will received the adhesive and the tiles. This process will increase the floor weigh in about 105 Kg/m2. Adding the tiles weight we will have 141kg/m2 or, more or less, 2 persons each square meter. But the appropriate and usual finishing for these flooring over the solid wood, was and it is yet a continuous finishing made with an appropriate layer like a mat of cloth, PVC, or epoxy resin. However as it was important to maintain the commercial look it was necessary to get an adequate solution for the finishing of the inside floors.

The Solution

A layer of something which allows the tiles movements in each direction must be necessary, and if possible a lightweight and easier material than the old fashioned sand and the mortar layers. The innovative *Schluter Systems* for similar cases was the solution as a lightweight construction method which can also be installed over the hard surfaces and it is particularly challenging and easy to do.

According to the manufacturer, it is a polyethylene membrane with a grid structure of small square cavities, with a dovetail configuration and an anchoring fleece laminated to its underside bonded to the substrate with appropriate mortar. Designed specifically for ceramic tile and dimension stone installations, *Schluter-DITRA-XL* serves as an uncoupling layer, waterproofing membrane, and vapor management layer that accommodates moisture from beneath the tile covering. Furthermore, *DITRA-XL* performs all these functions while still providing adequate support/load distribution for the tile covering. This membrane and its particular rib structure, allows the plane movements that effectively neutralizes the differential movement stresses between the substrate and the tile, thus eliminating the major cause of cracking and delaminating of the tiled surface. The polyethylene composition protects the substrate (floor slabs and wood structure) from moisture penetration, which is particularly important in this building where most materials are moisture sensitive.

The adhesive for ceramic tiles finishing is also from *Ditra* industry an appropriated elastomeric material base water sealing and bonding compound for this orange colored membrane in a thickness of 3 mm spread evenly with a notched trowel, work done by Italian expert workers, that are coming on purpose to Lisbon to do it, as shown in figures 6 and 7.

Figures 6 - 7 - The orange polyethylene *Ditra* membrane laid over the light concrete layer, the adhesive and the flooring tiles

After almost a year of the finishing of the shop, there is nothing to say about any deformations in the flooring, despite the inside temperature due to the air condition and the great movement of the shop.